High Frequency/High Variability Monitoring

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Real Time Monitoring for Organic Carbon in the Sacramento - San Joaquin Delta: Continuous Flow Measurements at Hood

Background

Waters of the Sacramento-San Joaquin Delta serve nearly 23 million people (two-thirds of California's population) living in the Bay-Delta region and in southern California. The Delta as a drinking water supply is, therefore, important to the public health and economy of the State.

One of the primary drinking water quality problems associated with the use of Delta waters as a drinking water source is the formation of disinfection byproducts (DBPs). Disinfection, which is necessary to protect against microbial disease, produces chemical byproducts (DBPs such as trihalomethanes and haloacetic acids) that may pose other health risks such as cancer, spontaneous abortions, and other acute adverse health effects (e.g., liver toxicity, kidney toxicity, and nervous system toxicity). DBPs are produced when chemicals used in the treatment process react with constituents in the source water. A primary concern when chlorine is used as a disinfectant in treatment is that it reacts with organic matter (measured as total organic carbon [TOC] or dissolved organic carbon [DOC]) to form trihalomethanes (THMs) and other DBPs (e.g. haloacetic acids), which are known to be toxic and carcinogenic.

In order to manage and improve the quality of waters in the Delta used for drinking water supply, the CALFED Drinking Water Program is in the process of synthesizing information and designing actions that will achieve continuous water quality improvement (with respect to DBPs) over the course of the next seven years. In general, the following knowledge about the Delta system is needed to attain the goal of continuous improvement:

- What are the baseline concentrations of TOC and other constituents of concern in Delta waters?
- What is the quality of that TOC with respect to DBP formation potential?
- What are the sources of TOC loads to and within the Delta?
- Which sources contribute the most loads and most reactive forms of TOC to drinking water supplies?
- Are there management actions that can be taken to reduce the most problematic loads or segregate those waters from drinking water supply?
- Have the CALFED actions to manage loads and/or segregate "hot" carbon from source waters effectively reduced the amount of "hot" carbon compounds diverted into drinking water supplies?
- Have in-Delta flow modifications affected the distribution and flux of "hot" carbon

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compounds within the Delta system? and
- Has there been a continuous improvement of source water quality as a result of the combined load, discharge, and flow management actions taken by the CALFED program?

This project addresses key data gaps for three of these broad information needs: baseline water quality conditions in source waters and diverted drinking water supplies, TOC loading from riverine sources, and assessment of continuous water quality improvement during and after the first phase of CALFED.

Some of the other information needs are currently being addressed by other CALFED projects and agency monitoring programs. These include:

- characterization of TOC loads and temporal variability of in-Delta agricultural drainage; and
- characterization of TOC loads from waste discharges;
- characterizing the loads and quality of carbon from different wetland types;
- identifying the quality of carbon most closely linked to DBP formation potential; and
- routine monitoring of the water quality of Delta channel waters and inputs to the channels.

The other broad information needs will be addressed as information from these initial studies becomes available to inform the management process.

Project Purpose

The purposes of this project are to (1) fill in data gaps needed to establish baseline water quality conditions in Delta channels with respect to TOC-related DBP formation, (2) obtain precise information on the loads, timing, and quality of carbon flowing into the Delta from the Sacramento Rivers, and (3) to establish baseline conditions and real-time monitoring capability for TOC diverted into drinking water supplies.

CALFED has developed several actions for implementation by each of its Programs, many of which have the potential to impact drinking water quality. The CALFED Drinking Water Quality Program has several proposed actions designed to improve drinking water quality. One of the key drinking water quality parameters likely to be affected by these projects is organic carbon. In order to assess the projected or actual impacts of these actions, appropriate water quality data will need to be collected at critical points in the Delta. This will require real-time monitoring in order to provide adequate data for making these assessments by way of computer modeling.

Real-time monitoring of organic carbon (TOC/DOC) has not been conducted in the Delta in the past. TOC/DOC data has typically been collected as grab samples for

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laboratory analysis on a weekly or monthly basis. This frequency of data has proven of limited value in establishing baseline water quality conditions or in tracking the influence of different sources and loads on TOC fluxes through the Delta channels. This is due to the fact the processes that govern TOC concentrations and fluxes occur at time scales as short as several hours (tidal) and as long as several years (water years). CMARP identified a need for monitoring TOC/DOC in a real-time network with sufficient accuracy to identify changes is sources and loadings that result from CALFED actions and alternatives.

The Department of Water Resources Municipal Water Quality Investigations Unit will be collecting real-time TOC/DOC data at critical Delta boundary locations, including the existing Environmental Services Office station at Hood on the Sacramento River. This work is described in companion CALFED proposals. This proposal is to add an additional flow monitoring station at Hood to an existing Delta flow monitoring network operates by the USGS as part of the Interagency Ecological Program.

Project Description

The objective of this study is to measure and provide continuous flow measurements at the Hood Monitoring Station (operated by DWR-Environmental Services Office) for a one-year period. These data can then be used to interpret high frequency TOC and water quality parameter data being collected by MWQI and ESO at the same site over the same period of time. Together, these data will provide information to CALFED on:

- The loads of total organic carbon moving into the Delta from the mainstem of the Sacramento River ;
- the variability of organic carbon and other constituents across tidal, spring-neap, and seasonal time scales; and
- provide a "proof of concept" pilot of a high-frequency monitoring ensemble that will enable CALFED to determine whether and to what extent similar ensembles will provide needed information in the design of future monitoring networks

Resulting data can be used in models currently being developed and tested by CALFED that will provide a means of establishing baseline water quality conditions, assessing the sources and loads of TOC/DOC, and evaluating the impacts or success of CALFED Program Actions on drinking water quality. This proposal was explicitly designed to fill in gaps not currently covered by the MWQI, Interagency Ecological Program, or USGS existing monitoring programs.

The Hood monitoring station on the Sacramento River maintained by the Environmental Services Office on the Sacramento River was selected as the site for the pilot multiparameter high frequency monitoring station because a) the infrastructure capable of housing all instruments currently exists; b) it is located on the main channel of the Sacramento; c) it is tidally influenced and subject to variability on short time scales; and d) data from this site can be used as a baseline should CALFED decide to construct a

second cross-channel.

Project Tasks

Task 1: Install Acoustic Doppler Current Profiler (ADCP) and Calibrate Equipment to Site Conditions

There is currently no flow measurement device at the Hood site. This task involves purchasing an ADCP, testing the equipment, installing of the equipment and calibrating the equipment to the specific site conditions. Site characterization includes measuring channel flows across tidal cycles to evaluate cross channel variability and develop ratings for flow sensors. Installation includes positioning the sensors and securing ancillary equipment such as cables and data loggers for telemetering data.

Task 2: Site Operation, Data Collection, and Data Reporting

Maintain flow monitoring sensors, periodically conduct additional flow calibration measurements, QA/QC data, and post reviewed data on web as part of regular real-time data reporting from the IEP Delta flow monitoring network for a period of one year after installation (USGS).

Personnel

These tasks will be conducted by hydrologists from the USGS California District office in Sacramento. Personnel costs are for the additional time necessary to install and operate one additional flow monitoring station in an existing network. Development and capital costs associated with boats, data reporting systems, etc. have already been covered by existing interagency programs.

Workplan and Project Costs

Table 1. Workplan and Project Costs

Task	Schedule	Implementing Agency	Cost
Task 1: Install flow monitoring equipment and calibrate to site	7/1/00-11/30/00*	USGS	$62,053
Task 2: Site Operation, Data Collection, and Data Reporting 1B3 Flow data	11/30/00-11/30/01	USGS	$20,407
Total			$82,460

Schedule assumes work agreements are finalized by 6/30/00 and includes 3-months for manufacture of ADCP to specifications.

Two invoices will be submitted to the US EPA: one after completion of Task 1 and the

second after completion of the project.

Table 2. Detailed Budget

Task	Direct Labor (days)	Direct Salary and Benefits	Equipment and Supplies	Overhead	Total
Task 1	99	21,780	11,000	29,273	62,053
Task 2	49	10,780		9627	20,407
					82,460